

REMARKS

By this Response, claim 1-3, 8, 16, and 18 have been amended. Claims 11-15 are withdrawn. Claims 7 and 17 have been canceled. Claims 21 and 22 have been added. Claims 1-6, 8-16, and 18-22 are pending. Support for the amendments to claims 1 and 16 can be found throughout the as-filed specification and claims, in particular at paragraphs [0024], [0025], [0032] and [0036]. No new matter has been added.

Interview Summary

At the outset, the Examiner is thanked for the consideration given during the Interview of March 4, 2008. During the Interview, the Examiner agreed that the proposed claim amendments overcome the references of record. The substance of the Interview can be found throughout the following response.

Rejection of Claims 1, 2, 4-6, 9, 10, 16, 19 and 20 Under 35 U.S.C. § 102(b)

In the Office Action, the Examiner rejected claims 1, 2, 4-6, 9, 10, 16, 19 and 20 under 35 U.S.C. § 102(b) as being anticipated by *Kondo et al.* (U.S. Patent No. 5,656,858). This rejection is respectfully traversed.

The subject matter of independent claims 1 and 16 are directed to methods comprising, *inter alia*, forming a surface conductive lead in an opening formed within a protective overcoat and over a barrier layer, the barrier layer providing additional adhesion between the protective overcoat and the surface conductive lead, a portion of the barrier layer extending beyond the surface conductive lead; providing a seed layer

contacting the barrier layer and at least partially within the opening of the protective overcoat; and subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt, the dry etch selective to the barrier layer.

It is the Examiner's position that *Kondo et al.* disclose a method for manufacturing an integrated circuit as claimed, referring specifically to FIGS. 7A-7E; column 3, lines 40-41 and element 101; elements 103, 104, 105, 108; column 10, lines 33-39; and column 7, lines 65-67.

To the contrary, it is respectfully submitted that *Kondo et al.* fail to teach each and every limitation of the claims. Specifically, *Kondo et al.* do not teach a barrier layer providing additional adhesion between a protective overcoat and surface conductive lead or providing a seed layer contacting the barrier layer as claimed. It can be seen from at least FIG. 7E and related disclosure of *Kondo et al.* that the presence of the interposed film 106 prevents the "seed" film 107 from contacting the barrier metal 105 therein. Additionally, the bonding layer 106 between the barrier metal 105 and Cu film 107 in *Kondo et al.* appears to be specifically related to improving strength between the film 107 and the barrier metal 105 rather than providing additional adhesion between the protective film 104 and bump structure 110 as claimed in the instant invention. See at least column 8, lines 24-32 therein. Since *Kondo et al.* fail to teach every limitation of the claims, no *prima facie* anticipation exists.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claims 1, 2, 4-6, 9, 10, 16, 19 and 20 under 35 U.S.C. § 102(b). Applicants respectfully submit that claims 2, 4-6, 9, 10 and claims 19, 20 are in

condition for allowance, at least by virtue of their dependency from allowable claims 1 and 16, respectively.

Rejection of Claims 1, 7, 16 and 17 Under 35 U.S.C. § 102(b)/103(a)

In the Office Action, the Examiner rejected claims 1, 7, 16, and 17 under 35 U.S.C. § 102(b) as being anticipated by *Lee et al.* (U.S. Patent Publication No. 2002/0121692), or in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over *Lee et al.* (U.S. Patent Publication No. 2002/0121692) in view of *Bojkov et al.* (U.S. Patent Publication No. 2005/0073048). These rejections are respectfully traversed.

The subject matter of claims 1 and 16 has been characterized above. Claims 7 and 17 further comprise subjecting the seed layer to a wet etch prior to subjecting the portion of the barrier layer to the dry etch, wherein the wet etch is without substantially undercutting the etched seed layer or surface conductive lead.

It is the Examiner's position that *Lee et al.* or *Lee et al.* in view of *Bojkov et al.* disclose the claimed invention.

To the contrary, *Lee et al.* fail to teach each and every limitation of the claimed invention. Specifically, *Lee et al.* do not disclose a barrier layer providing additional adhesion between the layer 34 and metal pillar 38 therein. Instead, the layer 36/35 is only recognized as preventing diffusion of an interconnect metal into surrounding layers of dielectric and silicon. See paragraph [0079] of *Lee et al.* In addition, the wet etch of *Lee et al.* is intended to undercut the pillar metal as shown in FIG. 14 and described in at least paragraph [0094] thereof. In distinction, the present invention uses a wet etch

without substantially undercutting the etched seed layer or surface conductive lead as claimed.

With regard to the rejection combination of *Lee et al.* and *Bojkov et al.*, it is respectfully submitted that the Examiner's characterization of element 105a as the barrier layer and 105b as the seed layer is inaccurate according to a plain reading of *Bojkov et al.* Instead, 105a and 105b combine to form a seed layer as described in paragraph [0029] thereof. Accordingly, there is no portion of a "barrier layer" extending beyond a surface conductive lead subsequent to etching since the entire extending seed layer 104 or 105a/105b is etched in *Bojkov et al.* Thus, even in combination, the references to *Lee et al.* and *Bojkov et al.* fail to teach or suggest Applicants' claimed invention.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claims 1, 7, 16 and 17 under 35 U.S.C. § 102(b)/103(a). Applicants respectfully submit that claims 7 and 17 are in condition for allowance, at least by virtue of their dependency from allowable claims 1 and 16, respectively.

Rejection of Claim 3 Under 35 U.S.C. § 103(a)

In the Office Action, the Examiner rejected claim 3 under 35 U.S.C. § 103(a) as being unpatentable over *Kondo et al.* (U.S. Patent No. 5,656,858) in view of *Ashby et al.* (U.S. Patent No. 5,814,238). This rejection is respectfully traversed.

Claim 3 depends from claim 2 and further comprises nitrous oxide in the dry etch.

It is the Examiner's position that *Ashby et al.* overcome the deficiency of *Kondo et al.* by teaching the etching of tungsten titanium alloys using a dry etch of carbon tetrafluoride and nitrous oxide.

It is respectfully submitted that the reference to *Kondo et al.* fails at the outset for reasons presented above. The addition of *Ashby et al.* does not overcome these deficiencies, and the combination therefore also fails to teach or suggest the claimed invention.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claim 3 under 35 U.S.C. § 103(a). Applicants further submit that claim 3 is in condition for allowance, at least by virtue of its dependency from allowable claim 1.

Rejection of Claims 8 and 18 Under 35 U.S.C. § 103(a)

In the Office Action, the Examiner rejected claims 8 and 18 under 35 U.S.C. § 103(a) as being unpatentable over *Lee et al.* (U.S. Patent Publication No. 2002/0121692) in view of *Bojkov et al.* (U.S. Patent Publication No. 2005/0073048). This rejection is respectfully traversed.

Claims 8 and 18 are directed to the wet etch chemistry comprising hydrogen peroxide and sulfuric acid.

It is the Examiner's position that *Bojkov et al.* overcome the deficiency of *Lee et al.* by etching a copper seed layer with a wet etch chemistry of hydrogen peroxide and sulfuric acid, referring to paragraph [0034] thereof.

To the contrary, it is respectfully submitted that the reference to *Lee et al.* fails at the outset for reasons presented above. The addition of *Bojkov et al.* does not overcome these deficiencies, and the combination therefore also fails to teach or suggest the claimed invention.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claims 8 and 18 under 35 U.S.C. § 103(a). Applicants respectfully submit that claims 8 and 18 are in condition for allowance, at least by virtue of their dependency from allowable claims 1 and 16, respectively.

CONCLUSION

In view of the foregoing remarks, Applicants submit that this claimed invention is neither anticipated nor rendered obvious in view of the prior art references applied against this application. Applicants therefore request the Examiner's reconsideration and reexamination of the application, and the timely allowance of the pending claims.

If the Examiner believes that additional discussions or information might advance the prosecution of the instant application, the Examiner is invited to contact the undersigned at the telephone number listed below to expedite resolution of any outstanding issues.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 20-0668.

Respectfully submitted,

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